

Uterocervical Angle Anterior, Posterior, and Cervical Length Ultrasound as a Predictors for Successful Delay in Labor of Pregnant Women with Threatened Preterm Birth (PTB)

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ABSTRACT

Introduction: To determine whether the examination of the uterocervical angle anterior, posterior, cervical length, and combination can be used as a predictor of successful delay in labor in patients with threatened preterm birth (PTB). **Methods:** This is a prospective cohort analytical observational study of 44 women admitted to our hospital gestational age 28-36 weeks diagnosed with threatened preterm birth. Cervical length, anterior uterocervical angle, and posterior uterocervical angle examinations were performed. Patient then observed for 2x24 hours whether there was a delay in labor or not. If there is a delay, the patient followed until delivery. **Results:** CL cut off value > 2.66 cm delaying labor for 2x24 hours and > 2.81 cm delaying labor until term. UCA posterior cut off value < 113.2o delaying labor for 2x24 hours and < 107.8o delaying labor until term. Anterior UCA cut off values < 103.2o delaying labor for 2x24 hours and < 93.1o delaying labor until term. Statistical Analysis showed that CL was significant as a single tool for predictor of delayed labor either 2x24 hours or up to term, while posterior and anterior UCA was not. But if this 3 single tools combine, CL, anterior UCA, and posterior UCA was statistically significant as a predictor of delay in labor either 2x24 hours or until term, with the best predictive value is a combination of CL and posterior UCA of 25.2% for predicting delay of labor 2x24 hours and the combination of CL, posterior, and anterior UCA was 24.6% for predicting delay labor until term. **Conclusion:** Cervical length ultrasound examination and the combination of CL, anterior UCA, and posterior UCA can be predictors of delayed labor in patients with threatened preterm birth but not for anterior and posterior uterocervical angle as a single tool.

Key words: Threatened Preterm Birth (PTB), Preterm Delivery, Cervical Length, Uterocervical Angle Anterior, Uterocervical Angle Posterior.

INTRODUCTION

Preterm birth is an emergency condition in obstetrics, about 75% cause mortality in newborn in the worldwide has a strong relationship with threatened preterm birth (PTB).¹⁻³ Although there are various tools available to predict the incidence of preterm birth, such as fetal fibronectin and several biomarker tests, the difference between true preterm birth and threatened preterm birth is still being debated, in which about 15% of threatened preterm birth will progress to preterm delivery.^{4,5} Although there have been many diagnostic tests to assess prediction of preterm birth, none of them has become an international diagnostic guideline.

In 2010, Indonesia, as a low-middle country, is the largest contributor for preterm birth in the world, 15.5% of the total birth rate.⁶⁻⁸ In Our Hospital, in 2014 there are 18.84% preterm birth cases and cause neonatal mortality about 80.1%.⁹ Preterm birth is a result from activation of hypothalamus-pituitary-adrenal axis in fetal/maternal before time of delivery, inflammation and infection, decidual hemorrhage, and pathological uterus distention.^{7,10,11}

Early identification for pregnant women with a high risk for preterm delivery is important to provide adequate follow-up and treatment. The rate of preterm birth has only changed very little in recent years due to the lack of effective methods

to detect risk of preterm birth with appropriate screening tools to reduce this risk since it is not easy to identify which pregnant women will continue to have preterm labor and how long it will take to delay the delivery after the diagnosis is made and intervention is given. Evidence shows that ultrasound examination by measuring cervical length (CL) during the second trimester and by taking a history of the mother can help predict pregnant women who are at risk of preterm delivery. In a more recent study, the width of the anterior and posterior uterocervical angles (UCA), where this angle is formed between the endocervical canal and the anterior and posterior walls of the uterus, was a predictor of preterm labor.^{12,13}

The aim of this study is to assess the ability of uterocervical angle anterior, posterior, cervical length, and combination whether these parameters can be used as predictors of successful delay in labor in patients with threatened PTB.

METHOD

Study design

This research is a prospective cohort analytic observational study, conducted at dr. Sutomo Hospital.

Participants and settings

Patient diagnosed with threatened preterm birth at gestational age 28-36 weeks, who are admitted to

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delivery room at dr. Soetomo Hospital between May until September 2022 with that met the inclusion and exclusion criteria.

Eligibility criteria for the participants in this study patient with threatened preterm birth (defined as a regular uterine contractions occur 4 times in 20 minutes) with cervix dilatation 1 until 3 cm), singleton pregnancy, and intact amnion. Women were excluded from the study if they have a history of cervix conization, cerclage in previous pregnancy, inappropriate anatomy (uterine anomaly or placenta previa), and non-reassuring fetal status.

Sample size

Sample size was calculated by using predictive study formula, based on a sensitivity from previous study was 80%, an error of 0.2, and prevalence 0.276, sample size was 44 patients using consecutive sampling technique.

Test methods

After participants agreed for informed consent, demographic data were collected from medical record. Transvaginal images were obtained with GE Logic E9. UCA is a TVS marker defined as an angle between the lower uterine segment and the cervical canal. Cervical length was defined as line between internal and external ostium cervix, the angle created between anterior and posterior lower uterine and cervix are anterior and posterior UCA.

Analysis

All study subjects were given the same treatment, received tocolytic therapy and corticosteroids for fetal lung maturation. Before receiving therapy, sample was examined transvaginal ultrasound to assess cervical length, posterior UCA, and anterior UCA, then observed for 2x24 hours whether there was a delay in labor or not. If there is a delay in delivery, the patient will be followed until delivery. After all the data was collected, we analyzed it using SPSS and medCalc software.

Ethical consideration

Written informed consent and inform to consent was obtained from all participants. This study was registered in Soetomo Hospital Ethic Committee with registered number 1465/104/3/VI/2022.

RESULTS

Demographics

In our study, there were 44 patients with demographic characteristic are shown in Table 1 majority sample ages was 18-34 years old, youngest is 17 years old and oldest is 40 years old with mean 29 y.o (standard deviation, SD = 5.6 years). There is no significant statistical differences between two groups in patients characteristics. The outcome of delivery are 19 patients aterm (43.2%) and 25 patients preterm (56.8%).

Table 1: Patients demographics.

Variables	N	%	Group		P value
			28-31 week (N: 10)	32-36 week (N: 34)	
Age (year old)	29 ±5.6				
< 18	1	2.3	0	1	
18-34	35	79.5	9	26	0.589
>34	8	18.2	1	7	
Parity					
Nulliparity	19	43.2	6	13	
Multiparity	25	56.8	4	21	0.287
Education					
Elementary School	6	13.6	0	6	
Junior High School	8	18.2	1	7	
Senior High School	17	38.6	6	11	
Diploma	1	2.3	0	1	0.253
Bachelor	12	27.3	3	9	
Occupation					
House wife/student	24	54.5	7	17	
Working	20	45.5	3	17	0.306
BMI	26.6±6.01				
Underweight	2	4.5	0	2	
Normal	17	38.6	1	16	
Overweight	17	38.6	7	10	
Obesity Class I	2	4.5	0	2	
Obesity Class II	3	6.8	1	2	0.053
Obesity Class III	3	6.8	1	2	
Previous Delivery					
None (first child)	19	43.2	6	13	
Vaginal delivery	16	36.4	2	14	
Cesarean section	9	20.5	2	7	0.406
Prior Preterm Birth					
Yes	6	13.6	1	5	
No	38	86.4	9	29	0.237
Outcome Delivery					
≥ 37 weeks (aterm)	19	43.2			
< 37 weeks (preterm)	25	56.8			
Duration Delay of Labor	20.23 ± 21.452 days				
Minimum	0 day				
Maximum	74 days				

Table 2: Distribution of onset labor in 2x24 hours and 1-week patient with threatened preterm birth.

Onset Labor	Group		Total	P Value
	28-31 week	32-36 week		
Inlabor < 2x24 hours	0 (0%)	12 (27.3%)	12 (27.3%)	0.072
Inlabor > 2x24 hours	10 (22.7%)	22 (50%)	32 (72.7%)	
Labor within 1 week	2 (6.3%)	8 (25%)	10 (31.2%)	
Labor delayed > 1 week	10 (31.2%)	12 (37.5%)	22 (68.8%)	

Table 3: Cut Off value parameters CL, P-UCA, and A-UCA for delay labor 2x24 hours and aterm.

Parameters	Range value Total (N: 44)	Delay Labor > 2x24 hours				Delay Until Aterm				Preterm (N: 25)	P value
		AUC	Cut off value	Yes (N: 32)	No (N: 12)	P value	AUC	Cut off value	Aterm (N: 19)		
CL (cm)	1.08-3.90 (mean 2.80 ± 0.59)	0.792	2.66	2.97 (0.55)	2.38 (0.49)	< 0.001*	0.806	2.81	3.13 (0.49)	2.54 (0.55)	< 0.00001*
P-UCA (°)	66.4-163.4 (mean 120.66 ± 22.9)	0.610	113.2	116.57 (25.18)	130.42 (12.68)	0.02*	0.585	107.8	114.61 (26.49)	125.26 (19.21)	0.123
A-UCA (°)	56.05-158.8 (mean 111.4 ± 21.5)	0.682	103.2	108.99 (21.75)	117.19 (20.69)	0.219	0.644	93.1	106.81 (23.27)	114.91 (19.88)	0.338

Table 4: Diagnostic performance of cervical length, posterior UCA, anterior UCA, and combination for prediction delay labor in patient with threatened preterm birth (PTB).

Variables	Cut Off		Sensitivity (%)		Spesificity (%)		PPV (%)		NPV (%)		OR
	I	II	I	II	I	II	I	II	I	II	
CL	2.66 cm	2.80 cm	76.9	80	74.19	73.6	55.56	80	88.46	73.6	11.2
P-UCA	113.2°	107.8°	100	88	54.84	52.6	48.15	70.9	100	76.9	8.14
A-UCA	103.2°	93.1°	92.31	88	38.71	36.8	38.71	64.7	54.5	70	4.278
CL & P-UCA	(-)	(-)	78.5	76.0	86.6	84.2	73.3	86.3	51.4	72.7	16.88
CL & A-UCA	(-)	(-)	90.9	72.0	78.7	78.9	58.8	81.8	96.2	68.1	9.64
P-UCA & A-UCA	(-)	(-)	92.3	76.0	74.2	78.9	60	82.6	95.8	71.4	11.87
CL, P-UCA & A-UCA	(-)	(-)	76.9	66.6	93.5	94.1	83.3	94.7	90.6	64	18.06

I: delay labor 2x24 hours

II: delay labor until aterm

Table 5: Logistic regression model performance of CL, P-UCA, and combination as a predictor of successful delay labor in patient with threatened PTB.

Variable	Delay Labor 2x24 hours (p-value)	Regression Value (R ²)	Delay Labor until Term (p-value)	Regression Value (R ²)
CL	0.01*	24.4%	0.003*	20.6%
P-UCA	0.075	5.4%	0.132	7.7%
CL + A-UCA	0.002*	24.9%	0.002*	21.2%
CL + P-UCA	0.0001*	25.2%	0.002*	22.9%
P-UCA + A-UCA	0.002*	11.7%	0.004*	13.9%
CL + P-UCA + A-UCA	0.0001*	20.9%	0.001*	24.6%

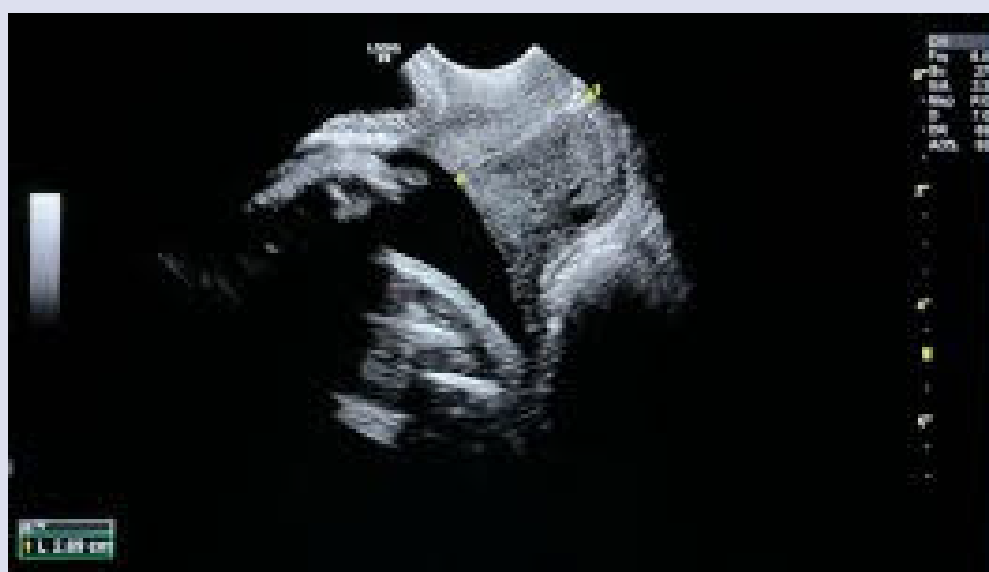


Figure 1: Cervical length by TVS.



Figure 2: Posterior UCA by TVS.

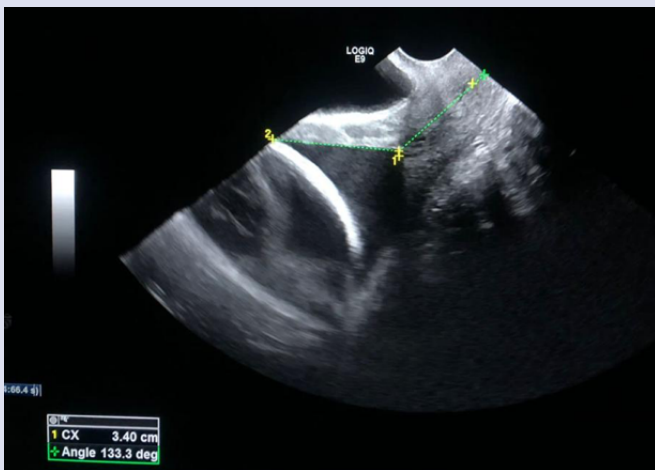


Figure 3: Anterior UCA by TVS.

Cervical length, anterior and posterior UCA examination

Cervical length values obtained with a mean of 2.8 cm \pm SD 0.598. The posterior UCA mean is 120.6° \pm SD 22.98 and the anterior UCA mean is 111.4° \pm SD 21.54. In this study, cut-off point of cervical length >2.66 cm for delayed labor 2x24 hours and >2.81 cm for delayed labor until term. Posterior UCA cut off value <113.2° for delayed labor 2x24 hours and <107.8° for delayed labor until term. In Table 2, showed that patients in group 32-36 week has a higher proportion booth in labor within 1 week and delayed labor than patients in group 28-21 week (6.3% vs 25% and 31.2% vs 37.5%).

DISCUSSION

This is the first prospective observational cohort study to investigate the diagnostic performance of Cervical Length, Posterior UCA, Anterior UCA, and combination for prediction delay labor in patient with threatened preterm birth (PTB).

There have been many studies related for prediction of preterm birth based on cervical length ultrasound examination. This indicates that a few weeks before labor, the cervix will shorten. This process starting from the internal os of the cervix, then softening of the cervix occurs due to cervical microstructural changes, namely tissue hydration, changes in collagen structure, and changes in elasticity.¹⁴ Previously, changes in the cervix could be identified by VT examination but this

examination is very subjective and varies according to the examiner. An objective examination is needed to predict the threat of preterm birth transvaginal ultrasound of the cervix which has better accuracy than transabdominal ultrasound.¹⁵

Many CL examinations have been carried out before and have been shown that have an impact on the incidence of threatened preterm birth. Likewise, in this study, CL had a significant relationship in the process of delaying labor 2x24 hours or until term. Research conducted by Hiersch et al also stated that cervical length has a significant association with the risk of preterm delivery in patients who come with the threat of preterm birth and obtain cervical dilatation <3 cm.⁴

In this study, a transvaginal ultrasound examination was performed to assess cervical length and the cutoff point of cervical length was 2.66 cm (p value <0.001) on the ROC curve for delaying labor 2x24 hours with a sensitivity, specificity, PPV, NPV, and OR 76.9 %, 74.2%, 55.5%, 88.4%, and 9.53 with 95% CI (0.643-0.899). The cut off cervical length for delaying labor until term is 2.81 cm on the ROC curve with a sensitivity, specificity, PPV, NPV, and OR of 80.0%, 73.7%, 80.0%, 73.7 %, and 11.2 with 95% CI (0.659-0.910). When compared with references, there is a difference where the reference states that the cutoff point of cervical length is 2.5 cm.^{16,17} Cervical length sensitivity and specificity are quite high and CL < 2.81 cm there is a 11.2-fold risk of preterm delivery in patients who come with a risk of preterm birth.

Cut off point 93.1° was obtained for anterior UCA with a sensitivity of 88% and low specificity 36.8% (p 0.123) has a weak relationship in predicting the success of delayed labor in patient with threatened PTB. The earliest study conducted by Luechathananon and Perez also obtained a p value > 0.05, while the Llobet and Dziadozs study found a strong relationship.^{12,14,18} Posterior UCA examination more limited comparing with anterior UCA and examination of the posterior UCA is said reflect more accurate than anterior UCA. This angle is thought to be a more objective examination tool in predicting labor in less than 24 hours.¹⁹ In this study, posterior UCA examination was statistically significance as a predictor of the succesful of delaying labor 2x24 hours in threatened preterm birth (cut off 113,2° with p value 0,02) but not in delaying labor until term (cut off 107,8° with p value 0,123). For combination of this tools, in our study combination of P-UCA and A-UCA has a higher sensitivity and combination CL, P-UCA and A-UCA has a higher specificity in patient with threatened preterm labor for delaying labor in 2x24 hours. Combination of CL and P-UCA has a higher sensitivity and combination CL, P-UCA and A-UCA has a higher specificity in patient with threatened preterm labor for delaying labor until term.

As for the logistic regression test on the combination of three variables themselves, it showed good results, where variations in the combination of CL, P-UCA, and A-UCA examinations were statistically significant as predictors of delay in labor both at 2x24 hours and until term in patients with PTB, with the best predictive value was the combination of CL and posterior UCA of 25.2% in predicting delayed labor for 2x24 hours and the combination of CL, posterior and anterior UCA of 24.6% in predicting delayed labor until term. In accordance with the results of this study, the authors recommend a combination of this three examinations as an alternative method of examining CL alone for prediction of successful delay labor in patient with PTB.

This study has some limitations that can influence the results, we did not perform serial transvaginal ultrasound examinations to assess periodic changes in variables. Bias of the examiner can also affect the results, even though it was carried out by one operator but not blinded in determining the outcome. In addition, the small number of samples can affect the results of this study so that further research is expected on a larger scale. However, this study also had advantages, we choose prospective cohort study and patients were followed until

delivery occurred with confounding factors such as demographics and comorbidities having been analyzed and no significant significance was obtained so that this study was more controlled. In addition, this research is a research that carries out a combination of examinations where there has been no previous research conducted in Indonesia which might be a reference for further larger research (multi-center study).

CONCLUSION

In this study, it was concluded that cervical length ultrasound examination and the combination of CL, anterior UCA, and posterior UCA could be predictors of delayed labor in patients with threatened preterm birth (PTB) either 2x24 hours or until term but not anterior and posterior uterocervical angle as a single tool.

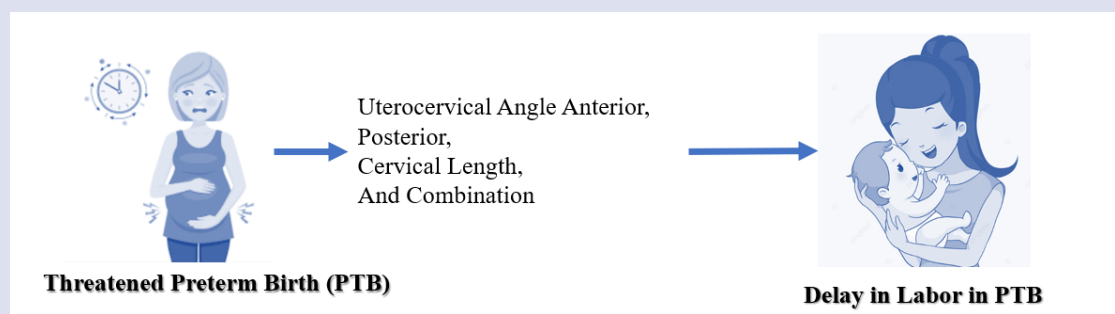
CONFLICTS OF INTEREST

There are no conflicts of interest to declare.

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GRAPHICAL ABSTRACT



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